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# BIODIESEL PRODUCTION FROM JATROPHA OIL AND COMPARISON OF PHYSIO-CHEMICAL PROPERTIES WITH ASTM STANDARDS OF BIODIESEL

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## ABSTRACT

*The present work showed the production of jatropha biodiesel through trans-esterification process. A magnetic stirrer and a water bath are used for fully conversion of biodiesel. The physio-chemical properties of produced biodiesel are also found to be closer to the high speed diesel and ASTM standards of biodiesel*

**KEYWORDS:** *Jatropha biodiesel, trans-esterification, ASTM standards of biodiesel*

The biodiesels are produced from various edible and non-edible oils through various processes like trans-esterification, pyrolysis etc (Dhingra et al., 2013a; Dhingra et al., 2013b; Dhingra et al., 2014a; Dhingra et al., 2014b; Dhingra et al., 2014c; Dhingra et al., 2014d; Dhingra et al., 2016a; Dhingra et al., 2016b ). Various researchers (Chen et al., 2008; Abdullah et al., 2009; Jeong and Park, 2009; Silva et al., 2011; Abuhabaya et al., 2013) have worked on biodiesels to run the diesel engines by blending with diesel in certain amount. The aim of the current work is to produce the biodiesel from jatropha oil. The most common method of producing biodiesel from various edible and non-edible oils is by the use of

trans-esterification process. The same process has been adopted for the production of biodiesel. A magnetic stirrer available in U.I.E.T, M. D. U, Rohtak, Haryana (India) as shown in left of figure 1 has been used in the present research work. The magnetic stirrer uses a rotating magnetic field to cause a magnetic capsule (or stir bar) immersed in a solution to spin at high speed, thus stirring the solution. A digital tachometer was used to measure rpm of the stirrer. The magnetic capsules are usually Teflon coated to prevent contamination of the solution. The magnetic capsule is also shown in right side of figure 1.

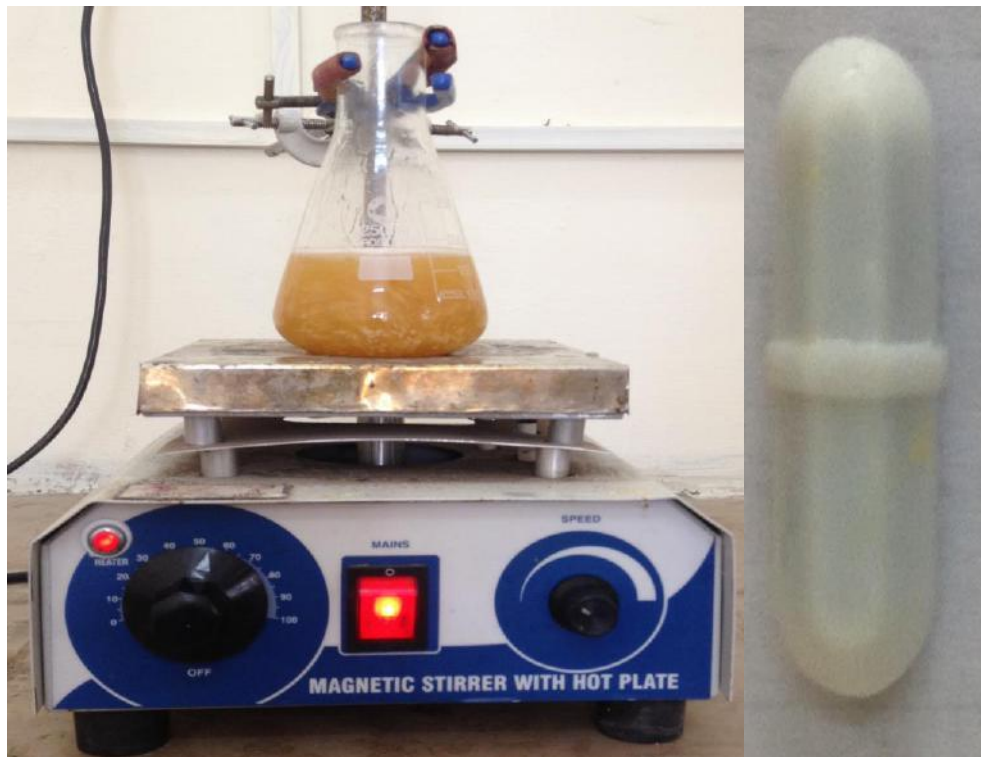


Figure 1: Magnetic stirrer and capsule used for biodiesel production



Figure 2: Water bath

Biodiesel was produced by trans-esterification process using a magnetic stirrer. Initially ethanol and catalyst (KOH) were properly mixed in a reaction vessel using magnetic stirrer. Oil (edible/non-edible) and mixture of ethanol & KOH were charged into another vessel and were mixed using the same magnetic stirrer. The time period of mixing of oil-ethanol-KOH solution was noted as mixing time. A digital stop watch was used to measure the time. The oil-ethanol-KOH solution was then placed in a water bath at a particular temperature till two layers of biodiesel and glycerol were formed. The water bath temperature was controlled with the help of a 1500 watt electric heater. The condenser

space was provided in the water bath to evaporate ethanol left during the reaction. The water bath used is shown in figure 2. The reaction products biodiesel and glycerol were finally separated using separating funnel. The time of separation is called settling time. Settling time added to mixing time gives the reaction time.

The various physical and chemical properties of jatropha oil and its produced biodiesel are measured from standard instruments (mentioned in table 1). It is observed that all the properties are closer to high speed diesel and ASTM standards of biodiesel.

**Table 1: Comparison chart of jatropha oil and its produced biodiesel with high speed diesel and American standards of biodiesel**

Property	Jatropha		HSD	Standards
	Oil	Biodiesel		ASTM (6751- 02)
<b>Kinematic viscosity (mm<sup>2</sup>/s)</b>	54	4.23	2.60	1.9 - 6.0
<b>Calorific value (kJ/kg)</b>	42275	42673	42000	39000 – 43000
<b>Cetane number</b>	51	53	50	47
<b>Density (kg/m<sup>3</sup>)</b>	865	873	850	850 – 879
<b>Cloud point (°C)</b>	2	10.2	8.5	5-12
<b>Pour point (°C)</b>	3.1	4.2	4	3-5
<b>Flash Point (°C)</b>	220	148	68	130
<b>Specific gravity</b>	0.91	0.93	0.90	0.85 - 0.94
<b>Iodine value</b>	110.5	109	-	85 – 115
<b>Saponification value</b>	192	186	-	180 – 185
<b>Moisture content (wt. %)</b>	0.07	.02	-	0.05 % max.

**CONCLUSION**

Ethanolysis of jatropha oil has been successfully achieved through trans-esterification process. The various properties of jatropha oil and its produced biodiesel lie in the range of ASTM standards.

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